REMARKS/ARGUMENTS

In the final Office Action dated June 7, 2006, Claims 1, 2, 4-14, 16-25, and 36-44 are pending. Claims 1, 2, 4, and 10-14 are rejected under 35 U.S.C. § 103(a) as being unpatentable over U.S. Patent No. 4,882,823 to Weisert, et al. in view of U.S. Patent No. 5,024,369 to Froes, et al. Claims 5-9, 16-25, and 36-44 are rejected under § 103(a) as being unpatentable over Weisert, et al. in view of Froes, et al. and in further view of U.S. Patent No. 5,118,026 to Stacher.

Applicant respectfully traverses the rejections made under § 103(a) and requests reconsideration of the claims in light of the following remarks.

Claim 1 is directed to a method for superplastically forming a refined-grain titanium blank at a relatively low temperature to produce a structural member. In particular, the method includes providing a blank, which comprises titanium and has a grain size between about 0.8 and 1.2 micron. The blank is heated and superplastically formed at a forming temperature of less than 1450 °F to produce the structural member having a predetermined configuration.

As previously asserted, none of the cited references discloses a method of superplastically forming such a refined-grain titanium blank at a temperature of less than 1450 °F. Weisert, et al. does not disclose either the claimed grain size or temperature. In fact, as acknowledged in the Office Action, "Weisert lacks disclosure of specific grain sizes for the titanium blank" (Office Action, page 3) and teaches a temperature range of about "1450° F–1750° F, preferably, 1650° F–1750° F" (Weisert, et al. at col. 4, lines 15-19), not less than 1450° F as claimed.

The Office Action refers to Froes, et al. as disclosing "an average grain size of about 2 to 20 microns" and concludes that "it would have been obvious . . . to modify the process of Weisert to include the grain size restraints of Froes in order to permit fabrication of airframe and engine structures with significant cost and weight reduction." Office Action, page 3.

Applicant previously asserted that Froes, et al. does not disclose the claimed grain size. The final Office Action apparently has withdrawn the previous assertion made in the first Office Action that Froes, et al. teaches "'about 2 microns' to be an art recognized result effective variable depending on the type of material to be used." Office Action of February 15, 2006, page 7. However, the final Office Action now takes the position:

> Froes teaches Ti-6Al-4V as a suitable alloy for the disclosed process (Froes et all, col. 3, lines 55-58) and discloses an average grain size of about 2 to 20 microns (Froes et al., col. 4, lines 14-15). The examiner reminds the applicant that the claimed range including "about" 0.8-1.2 micron substantially encompasses within 10 percent of the claimed range (therefore, 0.72-1.32 microns). 10 percent of Froes disclosure of "about" 2 microns is "about" 1.8-2.2 microns. 1.32 microns is sufficiently close to 1.8 microns; therefore, it is the examiner's position that the amounts in question are so close that [it is] prima facie obvious that one skilled in the art would have expected them to have the same properties. *Titanium Metals Corp. v. Banner*, 227 USPQ 773.

Office Action, page 9.

Applicant disagrees on multiple bases. First, given the disclosure of the present application, one skilled in the art would not have expected the fine-grain material of the blank of Claim 1 to have the same properties as the materials disclosed by Froes, et al. The present application specifically discloses that "the grain size can be less than 2 micron, such as between about 0.8 and 1.2 micron and, more particularly, about 1 micron" and, further, describes that such fine grain titanium can be superplastically formed and diffusion bonded at lower temperature and at higher strain rates than conventional operations, such that "the blanks **12** of the present invention generally can be formed at lower temperatures and faster forming rates." Paragraphs [0029] and [0031]. As noted below, Froes, et al. does not provide any specific disclosure of any grain sizes but merely discloses a range of average beta grain sizes. Claim 1 recites grain sizes smaller than any of the range of grain sizes disclosed by Froes, et al. Accordingly, one skilled in the art would have expected the fine-grain material of the blank of Claim 1 to be characterized by forming and bonding temperatures and forming strain rates that are different than the properties of the materials disclosed by Froes, et al. Accordingly, Applicant submits that Claim 1 is not prima facie obvious over the disclosure of Froes, et al.

Moreover, Applicant respectfully disagrees with the characterization and reliance on *Titanium Metals Corp. v. Banner*, 778 F.2d 775, 227 USPQ 773 (Fed. Cir. 1985). First, *Titanium Metals* does not support the proposition that the use of the term "about" preceding a range indicates that the range "substantially encompasses within 10 percent of the claimed range." Nor does *Titanium Metals* support the above assertion that the claimed range is so close

to the range set forth by Froes, et al. that it is prima facie obvious that one skilled in the art would have expected them to have the same properties. To the contrary, the relevant issue raised in *Titanium Metals* concerned a claim to a composition having 0.3% Mo, 0.8% Ni, balance titanium, while the prior art disclosed two alloys, one having 0.25% Mo, 0.75% Ni and the other having 0.31% Mo, 0.94% Ni. Thus, relative to the claimed composition, the first composition of the prior art had about 16.7% less Mo and 6.3% less Ni, while the second composition of the prior art had about 3.3% more Mo and 17.5% more Ni than the claimed composition. Accordingly, the prior art demonstrated compositions having more and less of each component, and the patentee produced no evidence to rebut a prima facie case that "one skilled in the art would have expected them to have the same properties." *Titanium Metals* at 783. As noted above, a person skilled in the art of the present invention would not have expected the material of the blank of Claim 1 to have the same properties as the material of Froes, et al.

Further, unlike the facts in *Titanium Metals*, the recited range of Claim 1 is significantly different from any of the grain sizes disclosed by the cited reference. In particular, the highest value of the range recited in Claim 1 is 1.2 microns. The lowest value of the range disclosed by Froes, et al. is 2 microns, a value that is about 66.7% higher than 1.2 microns. Nor does Froes, et al. disclose examples that are both higher and lower than the claimed values.

Further still, in *Titanium Metals*, the prior art reference disclosed specific values that were similar to those set forth in the claims. In contrast, Froes, et al. merely discloses a range of values. The Federal Circuit has held that "the disclosure of a range . . . does not constitute a specific disclosure of the endpoints of that range." *Atofina v. Great Lakes Chemical Corp.*, 441 F.3d 991 (Fed. Cir. 2006), 1000. In *Atofina*, the court held that a district court clearly erred in finding that a prior art disclosure of a preferred range of 150 – 350C anticipated a claimed range of 330 – 450C, noting that the "disclosure is only that of a range, not a specific temperature in that range, and the disclosure of a range is no more a disclosure of the end points of the range than it is of each of the intermediate points. Thus, [the prior art reference] does not disclose a specific embodiment of the claimed temperature range." *Id.* Similarly, the court also held that "the disclosure of a 0.001 to 1.0 percent range in [the prior art reference] does not constitute a specific disclosure of 0.1 percent to 5.0 percent," noting that "although there is a slight overlap, no reasonable fact finder could determine that this overlap describes the entire claimed range

with sufficient specificity to anticipate this limitation of the claim. The ranges are difference, not the same." *Id.* Thus, in *Atofina*, the Federal Circuit specifically discussed and distinguished *Titanium Metals*:

> Titanium Metals stands for the proposition that an earlier species reference anticipates a later genus claim, not that an earlier genus anticipates a narrower species. 778 F.2d at 782. Here, the prior art, JP 51-82250, discloses a temperature range of 100 to 500C which is broader than and fully encompasses the specific temperature range claimed in the '514 patent of 330 to 450C. Given the considerable difference between the claimed range and the range in the prior art, no reasonable fact finder could conclude that the prior art describes the claimed range with sufficient specificity to anticipate this limitation of the claim. Because the court's determination that JP 51-82250 disclosed the temperature range in claims 1, 2, 6, 7, 8, and 10 of the '514 patent was grounded in its erroneous application of Titanium Metals, we must reverse its finding of anticipation based on the temperature range.

Atofina at 999.

In the present application, Froes, et al. discloses a range of values. The disclosure of a range of 2-20 microns in Froes, et al. does not constitute a specific disclosure of the lower endpoint of that range for the same reasons identified by the Federal Circuit in *Atofina*. Thus, Applicant respectfully submits that Froes, et al. cannot be properly relied upon for a specific disclosure of 2 microns. Further, Claim 1 is even further distinguished from the disclosure of Froes, et al. than the circumstances described in Atofina in that the range disclosed in Froes, et al. does not encompass or even partially overlap the claimed range. Therefore, the specific range of Claim 1 is neither anticipated nor made obvious by the disclosure of Froes, et al.

Accordingly, this deficiency of Weisert, et al. is not cured by Froes, et al. or the other cited references, and Applicant therefore submits that Claim 1 is allowable for this reason. Similarly, the other independent Claims 16 and 36 include a similar recitation and therefore are also allowable, as are each of the dependent claims.

In addition, Applicant again objects to the combination of Froes, et al. with Weisert, et al. Froes, et al. describes conventional techniques for producing rapidly-solidified foil that is "about 10 to 100 microns thick, with an average beta grain size of about 2 to 20 microns, which is

substantially smaller than the beta grain size produced by ingot metallurgy methods." According to Froes, et al. "[t]he requirements for multi-step and expensive thermomechanical processing for converting ingot material into sheetstock and foil having a desireable generally uniform and equiaxed grain structure are now unnecessary." Weisert, et al., on the other hand, discloses a method of using multiple sheets that have selected mass distributions. It would not have been obvious to use the thin sheets of rapidly-solidified foil of Froes, et al. to form a structure having varying mass distribution as disclosed by Weisert, et al. The selected mass distributions of Weisert, et al. are achieved by providing each sheet with one flat surface and an opposite surface that is contoured according to the desired mass distribution of the final structure. *See, e.g.*, col. 4, lines 31-48. Neither Weisert, et al. nor Froes, et al. discloses that such surface contouring for achieving mass distribution can be achieved with rapidly-solidified foil that is about 10 to 100 millionths of an inch thick. Further, Weisert, et al. specifically teaches away from a process of achieving a mass distribution by cutting and stacking flat sheet stock, noting various problems such as difficulty in controlling the aggregate thickness of stacked sheets, voids created by the edges of sheet details, and buried weld nuggets. *See* col. 1, line 46 – col. 2, line 31. Thus, as previously explained by Applicant, the references cannot be combined fairly as suggested in the Office Action.

The final Office Action states that the feature of surface contouring for achieving mass distribution is not recited in the claims. Applicant has never contended that the claims recite this feature; rather, these features of Weisert, et al. are pointed out to illustrate why Froes, et al. and Weisert, et al. cannot properly be combined, as described above. Further, the final Office Action does not disagree with Applicant's prior contention that Wesiert, et al. teaches away from a process of achieving a mass distribution by cutting and stacking flat sheet stock. Instead, the final Office Action states that "the MPEP states, 'patents are relevant as prior art for all they contain.'" Office Action, page 10.

Applicant disagrees with this suggestion that a patent's specific teaching away from a feature can be disregarded. In this regard, the Court of Appeals for the Federal Circuit has held that a prior art reference should be considered as a whole and portions teaching away from the claimed invention must be considered. *See, e.g., Bausch & Lomb, Inc. v. Barnes-Hind/Hydrocurve, Inc.*, 796 F.2d 443 (Fed. Cir. 1986) (noting that the lower court erred in failing

to consider a prior art reference in its entirety and thereby ignoring portions of the reference that argued against obviousness); *Kloster Speedsteel AB v. Crucible Inc.*, 793 F.2d 1565 (Fed. Circ. 1986), *reversed on other grounds* ("[T]he inventor achieved the invention set forth in claim 30 by doing what those skilled in the art suggested should not be done, i.e., using lower temperatures, a fact strongly probative of nonobviousness.")

Further, Applicant has noted this apparent teaching away of Weisert, et al. in connection with its argument that the Weisert, et al. cannot be combined with Froes, et al. as set forth in the Office Action. The Office Action cites caselaw relevant to the proposition that a reference that anticipates an invention is still anticipatory, even if the reference goes on to disparage the invention. For example, the Office Action cites a passage in *Celeritas Technologies Ltd. v. Rockwell International Corp.*, 150 F.3d 1354 that addresses the use of such a reference in a rejection based on anticipation. The court states that the question of whether a reference teaches away from the invention is inapplicable to an anticipation analysis, but that is irrelevant to the present rejection made under § 103. For a rejection based on obviousness, the specific teaching away of a reference is relevant if, as in this case, it indicates what the reference does not suggest to a person of ordinary skill in the art. Accordingly, Applicant maintains that the references cannot fairly be combined as suggested and, for this additional reason, the references do not render any of the claims obvious.

Further, the various claims provide additional bases of distinction over the cited references. For example, dependent Claims 4, 17, and 37 recite that the blank has a grain size of about 1 micron. The Office Action has not identified any reference disclosing this feature. As noted above, Froes, et al. discloses a range, which does not constitute a specific disclosure of the endpoints of that range. *Atofina* at 1000. Even if the lower endpoint of the range of Froes, et al. were specifically disclosed, the value is 100% greater than the value recited in Claims 4, 17, and 37. Applicant respectfully submits that the claimed value is not anticipated or obvious in light of the cited references.

Claims 11 and 12 also stand rejected on the sole basis of being unpatentable over Weisert, et al. in view of Froes, et al. Claim 11 recites "superplastically forming the blank at a strain rate of at least about 6×10^{-4} per second." Claim 12 recites that the strain rate is "at least

about 1 x 10^{-3} per second." The Office Action does not point to any such teaching in the prior art references but rather merely states:

> Weisert also discloses that superplastic behavior enhances formability under compressive strain conditions (Weisert, col. 3, lines 47-49). Therefore, the properties and method of invention are so similar with that of the applicant's claimed invention it is necessarily present to arrive at the specified strain rates of claims 11 and 12.

Office Action, page 3.

The cited portion of Weisert, et al. states as follows:

> Superplasticity is the capability of a material to develop unusually high tensile elongation with reduced tendency toward local necking during deformation. Superplastic behavior also enhances formability under compressive strain conditions. However, this invention is particularly concerned with superplastic metals which are subject to contamination of surface integrity at forming temperatures.

Weisert, et al., col. 3, lines 44-51.

Thus, as previously explained in Applicant's April 18, 2006 amendment, Weisert, et al. does not teach or suggest the strain rates set forth in Claims 11 and 12. Further, Applicant disagrees with the contention set forth in the Office Action that "it is necessarily present to arrive at the specified strain rates of claims 11 and 12." As noted in the present application, "workpieces formed of titanium alloys are typically superplastically formed in a temperature range between about 1450 °F and 1850 °F at a strain rate up to about 3 x 10^{-4} per second." Paragraph [0002]. Since a higher strain rate would require higher pressures and/or result in higher stresses, it would not have been necessary or obvious to achieve the claimed strain rates using conventional materials, such as those used in the prior art references. Accordingly, Applicant respectfully submits that each of Claims 11 and 12 is patentable for this additional reason.

Independent Claim 16 is also directed to a method for superplastically forming a blank to produce a structural member. The method includes providing a blank of Ti-6Al-4V with a grain size of about 0.8-1.2 micron, heating the blank, and superplastically forming the blank at a forming temperature of less than about 1450 °F. Further, as a result of the superplastic forming, a layer less than about 0.001 inch thick of alpha case oxide is formed on the surfaces of the

structural member, and the structural member is pickled to remove the alpha case oxide layer. In addition to the distinctions identified above in connection with Claim 1, none of the cited references discloses the feature of forming an alpha case oxide layer that is less than about 0.001 inch thick during superplastic forming and removing the layer by pickling.

In response to remarks in the first Office Action, Applicant explained that Stacher refers to pickling solely for the purpose of preparatory cleaning before diffusion bonding (*see* col. 2, lines 39-65) and does not disclose pickling after a superplastic forming operation. Further, Stacher does not disclose forming an alpha case layer during superplastic forming, or that the layer can be formed in a layer of the claimed thickness. To the contrary, Stacher states that a controlled environment must be provided when superplastic forming titanium aluminides to prevent it from becoming embrittled and its integrity destroyed, as would occur if the titanium aluminide is not protected. *See* col. 2, lines 30-38.

The final Office Action now takes the position that "the applicant does not claim the [pickling] step must come after the superplastic forming operation (ex. "then" or "and then" language." Office Action, page 11. To the extent that the Office Action would require words like "then" or "and then" to specify an ordering of the steps, Applicant disagrees. In particular, Applicant submits that the plain meaning of Claim 16 does require that the pickling step must come after the superplastic forming operation. Claim 16 clearly recites that "a layer of alpha case oxide" is formed by the superplastic forming operation, and the claim also recites "pickling the structural member to remove the alpha case oxide layer." The layer removed by the pickling step is the same layer that is formed by the superplastic operation. The clear language of the claim requires that the layer be formed before it is removed and, thus, the superplastic forming operation must be performed first to form the layer before the pickling step removes the layer.

Accordingly, even in combination, the cited references fail to disclose the various features of the method set forth in Claim 16, i.e., that a layer of alpha case oxide is formed by the superplastic forming operation, that the layer is formed with a thickness of less than about 0.001 inch thick, or that the structural member is pickled to remove the alpha case oxide layer. Therefore, Applicant submits that Claim 16 is patentable over the cited references for this additional reason, as are each of the dependent claims.

Dependent Claim 18 further recites that the structural member is subjected to a pickling fluid, "thereby removing material from surfaces of the structural member at a rate less than about 5×10^{-5} inch per minute." Claim 19 recites that "less than about 0.001 inch" is removed from each surface of the structural member in the pickling step. The references do not disclose these features.

Nor do the references disclose that the structural member can be superplastically formed at a temperature of about 1425 °F, as recited in Claim 21. In this regard, the Office Action again relies on *Titanium Metals*:

> The examiner . . . reminds the applicant that the claimed range including "about" 1425 °F substantially encompasses within 10 percent of the claimed range (therefore, 1282.5-1567.5 °F). Weisert's disclosed 1450 °F temperature falls within this range; therefore, it is the examiner's position that the amounts in question are so close that [it is] prima facie obvious that one skilled in the art would have expected them to have the same properties. *Titanium Metals Corp. v. banner*, 227 USPQ 773.

Office Action, page 12.

Applicant again disagrees with the characterization and reliance regarding *Titanium Metals*. First, it is unclear what is meant by the statement that "the amounts in questions are so close that [it is] prima facie obvious that one skilled in the art would have expected them to have the same properties." The amounts in question are temperatures. One skilled in the art would not expect a temperature that is less than about 1450 °F (Claim 16) and, in particular, about 1425 °F (Claim 21) to have the "same properties" as a temperature of 1450 °F. Indeed, the present application specifically distinguishes these temperatures.

In addition, as noted above, *Titanium Metals* does not support the proposition that the use of the term "about" preceding a temperature indicates that the temperature "substantially encompasses within 10 percent of the claimed range." Indeed, Claim 21 does not even recite a range. Therefore, this statement in the final Office Action is apparently misplaced.

Moreover, as the Federal Circuit stated in *Atofina*, "Titanium Metals stands for the proposition that an earlier species reference anticipates a later genus claim, not that an earlier genus anticipates a narrower species. 778 F.2d at 782." *Atofina* at 999. Weisert, et al. does not

disclose a species that falls within a genus of Claim 21. Accordingly, Applicant submits that Claim 21 is allowable for this additional reason, in addition to those set forth above.

For the reasons set forth above, Applicant submits that each of Claims 1, 2, 4-14, 16-25, and 36-44 is now allowable.

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CONCLUSIONS

In view of the remarks presented above, Applicant submits that the present application is in condition for allowance. As such, the issuance of a Notice of Allowance is therefore respectfully requested. In order to expedite the examination of the present application, the Examiner is encouraged to contact Applicant's undersigned attorney in order to resolve any remaining issues.

It is not believed that extensions of time or fees for net addition of claims are required, beyond those that may otherwise be provided for in documents accompanying this paper. However, in the event that additional extensions of time are necessary to allow consideration of this paper, such extensions are hereby petitioned under 37 CFR § 1.136(a), and any fee required therefore (including fees for net addition of claims) is hereby authorized to be charged to Deposit Account No. 16-0605.

Respectfully submitted,

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